University of Zurich Research Priority Program on "Global Change and Biodiversity": An integrative approach to understand the world's most pressing challenges

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Mountain Ecosystem News

Newsletter of the Mountain Ecosystems thematic group

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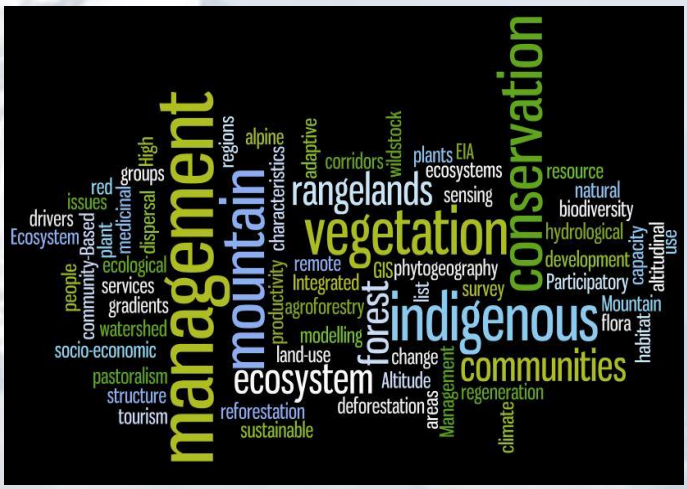
Editors: Omer Aijazi and Martin Price

Welcome to the METG Newsletter

This is the third newsletter of the METG, and the last in this intersessional period (2013-16), before the World Conservation Congress (WCC) in Hawai'i on 1-10 September. I would like to recognise the efforts of our new co-chair, Omer Aijazi, in contacting members and putting the newsletter together.

The METG was established during the previous intersessional period, in 2008, with the objective of "increased use of integrated approaches for ecosystem management across the world's mountain areas". Its members have been involved in organising and participating in two major conferences in Perth, Scotland in 2010 and 2015 (please see this issue for a brief report on the latest) as well as a major report on mountain forests in 2011, published by FAO. In addition, Paul Egan (the previous co-chair) and I worked with UNESCO's International Hydrological Programme to organise four workshops that led to a report and policy brief on the impacts of climate change in mountain areas, launched at the COP20 in 2014. And we have published the two previous newsletters, providing an overview of the activities of many of our members, who have increased in number from 48 in 2013 to 71 today.

I believe that there continues to be a need for a mountain emphasis within the CEM, given the continuing imperative for ecosystem management in mountain areas – as well as the number of CEM members working in these areas! As this wordle resulting from the survey of METG members in 2012-13 shows, you are interested in a wide range of topics.



However, if the new Chair of the CEM, to be elected at the WCC, agrees on this need, it will be necessary for a mountain group within CEM to find a clear niche among the many other activities of IUCN in mountain areas (particularly in WCPA, where mountain activities have been established for a long time) and the mountain activities of other organisations, most of which – including IUCN – are members of the Mountain Partnership. Probably, as in the past few years, activities in cooperation with other parts of IUCN or other organisations will be most productive. However, any mountain activities within CEM will have to be led by someone else because, after 8 years, I would not apply to take the lead again. I hope that one of you may be interested in doing so, working with Omer.

I hope that you find the articles in this issue of interest, and wish you all the best with your activities in mountain and other areas!

Martin Price

News from the Membership

Conservation of pollinators in the Indian Himalayas - *Pradeep Mehta*

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Decline in pollinators is a major global concern. Farmers in the Himalayan region of India are also observing a noted decline in pollinators. This is possibly due to the adverse consequences of mono cropping and excessive use of pesticides.

In the Kullu valley of Himachal Pradesh, only a small number of traditional bee hives remain active. The traditional practice of rearing bees in wall and log hives by farmers is on the decline. The situation is so extreme, that bee keepers from the lower foothills or the adjoining state of Punjab travel to the valley, renting out bee hives (specie *Apis mellifera,* approximately 800 per hive) for two weeks at a time to facilitate the pollination of apple trees.

Responding to this crisis, Dr. Mehta has designed a project which aims to enhance the diversity of pollinators and increase the population of native bee species (*Apis cerana*). The project titled, *Promoting Pollinators using Community-based Conservation approach at Kullu (Himachal Pradesh)* is part of the Shell Earthwatch Stakeholder Engagement Fund and is being implemented in collaboration with GB Pant Institute of Himalayan and Environment Development - an autonomous body of Ministry of Environment Forest and Climate Change. The project activities are expected to strengthen the conservation of important pollinator species and bee flora.

In order to provide forage for pollinators, efforts are being made to alter the habitat by growing mustard and coriander as cover crops under apples trees. Hedge row plantations are being promoted to provide forage and habitat for wild pollinators, including bumble bees, syrphid flies, solitary bees and drone flies.

An investment in the next generation, the project engages farmers including young people and women, and develops their knowledge of important pollinators and bee flora. They are being trained in bee keeping, biodiversity and ecosystem services. Traditional bee keeping practices (wall and log hives), are being revived and modern new boxes for native bee species (*Apis cerana*) are being promoted. The project also engages everyday citizens and corporate employees as "citizen scientists" who assist in data collection and increase their knowledge of the importance of biodiversity and ecosystem services.

Bee keeper with traditional log hive (Credit: Pradeep Mehta)

The emblematic Atlas cedar of the Maghreb - *Will Fletcher*

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Forest dieback in the context of anthropogenic climate change is a key concern at the global scale. *Cedrus atlantica*, the emblematic Atlas cedar of the Maghreb, is an IUCN Red List Endangered Species at threat from regional climate change, logging and pest attacks. Across wide areas of the species range in the Moroccan and

Algerian Atlas, dieback and poor seedling recruitment are evident.

Will Fletcher, a palaeoecologist at The University of Manchester, is exploring the long-term history and response of *Cedrus atlantica* to climate change in the Middle Atlas, Morocco. Thanks to collaborations with the University of Leipzig and Manchester Metropolitan University, a novel combination of techniques is being employed, focussing on a key study site of *Cedrus* dieback in the semi-arid southern Middle Atlas near Lake Sidi Ali. Via traditional palynological investigation of lake sediments, a new record of vegetation composition that charts the long-term rise and fall of *Cedrus* on the Holocene timescale is being completed.

Compared with previous research, emphasis on high (sub-centennial scale) temporal resolution and a robust radiocarbon chronology allows for insights into population dynamics at timescales well below the lifespans of these long-lived organisms and investigation of the response to past episodes of rapid climate change. Recent dynamics are being explored via dendrochronology and dendroclimatology, aiming to contextualise growth changes in response to recent decadal-scale drought within a multi-centennial-scale perspective that overlaps with the pollen record from the adjacent lake. Finally, geochemical signatures of environmental stress including stable carbon isotopes and UV-B responsive compounds are being explored in a new dataset of modern *Cedrus* pollen collected in autumn 2015 from sites across the altitudinal and climatic gradients of the species range. The geochemical work aims to lay the foundations for application to the Holocene record, with a view to a richer and more detailed understanding of both population dynamics and plant physiological response to the environment. This understanding will be valuable for refining scenarios of the species response to future change, and for the development of conservation and mitigation strategies.

If you are researching similar questions for other species/ecosystems/regions, please do not hesitate to get in touch!

Atlas cedars on the slopes of Lake Sidi Ali, Middle Atlas, Morocco, showing signs of tree crown dieback (Credit: Will Fletcher)

Mountains of our Future Earth - *Martin Price*

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The international conference “Mountains of Our Future Earth” took place in Perth, Scotland on 5-8 October 2015. It was organised by the Centre for Mountain Studies (CMS) at Perth College, University of the Highlands and Islands (UHI) and two global organisations – the Mountain Research Initiative (MRI) and the Global Mountain Biodiversity Assessment (GMBA). The conference was supported by these and other organisations, including the Swiss Agency for Development and Cooperation, the Austrian Academy of Sciences, and CEM, as well as a range of Scottish organisations.

A total of 400 scientists and practitioners from 52 countries participated, from a very wide range of natural and social science disciplines. They had the opportunity to present their research in 46 parallel sessions, 7 roundtables and a poster session, as well as to hear keynote presentations from 7 global experts. Most of

the keynotes and some of the parallel sessions were on themes of specific relevance to METG members, such as "Mountain ecosystem services, adaptive management and global change", "Mountain social-ecological system dynamics and resilience to global change", and "Challenges of land use decision-making in an increasingly nested and networked world".

The title of the conference indicated its aim to contribute to the new global Future Earth program, a 10-year international research initiative that will develop the knowledge to respond effectively to the risks and opportunities of global environmental change and support transformation towards global sustainability (see). This was the topic of the final panel discussion at the conference, bringing together scientists and research funders from around the world.

The abstracts of all the presentations at the conference are available from the CMS (info.cms@perth.uhi.ac.uk). Keynote presentations can be found on the MRI website as well as blogs about the parallel sessions can be accessed. at A special issue of the quarterly journal Mountain Research and Development will be published in 2016, including an analysis of all the presentations and a number of papers presented at the conference. Other special issues of journals are also planned. For more information, please visit the conference website.

Renewable energy demand in the Himalayas - *Sejuti Basu*

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The Himalayan mountain ecosystem is one of the most vulnerable ecosystems in the world with high sensitivity to climate variations and increasing levels of anthropogenic stress. The rural people of the Himalayas are highly dependent on the forests and pastures to fulfill their fuel needs. Fuelwood accounts for 60 - 80% of energy consumed in the region, resulting in very high stress on dwindling vegetation cover, especially in the cold desert belt. Finding alternatives to fuelwood is the need of the hour for the region. The breathtaking landscapes attract tourists from all corners of the word, and the sharp increase in their number has also increased the energy demand in the region. Grid-based solutions are expensive, snap easily, and have failed to address the local energy demand. Due to extreme remoteness, long history of neglect at policy level, these marginalized locations have seen extremely low penetration of renewable energy technology. A survey by Pragya on renewable energy demand across two districts in the cold desert belt of the Indian Himalayas brought out the current demand scenarios in households, agriculture and tourism sectors and the scope for renewable energy penetration for sustainable development in this sensitive ecozone. The report can be accessed here.

University of Zurich research priority program on "Global Change and Biodiversity": An integrative approach to understand the world's most pressing challenges - *Alejandra Parreño and Debra Zuppinger-Dingley*

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Global change refers to drivers (pollution, climate change, land use change, invasions, and exploitation) with either natural or anthropogenic origin, which affect the Earth and its capacity to sustain life. The University of Zurich Research Priority Program "Global Change and Biodiversity" aims at understanding and predicting global change drivers, their effects and feedbacks on biodiversity, ecosystem services and human well-being across scales. We are a group of 40 researchers spanning natural and social sciences, working on systems distributed along a latitudinal gradient ranging from Siberia (Kytalyk), to the Tibetan Plateau (Haibei), Switzerland (Laegern and Lake Zurich), Borneo (Sabah and Sarawak) and the Seychelles (Aldabra Atoll).

We address challenges using innovative and diverse approaches while promoting the participation of a wide range of stakeholders. For example, in the Arctic, temperatures are rising twice as fast as in the rest of the world, with major impacts on terrestrial ecosystems and their services that sustain the native human population.

Combining experiments, observations, and modelling, we investigate how changes in biodiversity, land surface energy budget and permafrost thaw in vast Siberian tundra landscapes, feedback to global change. The perception that local people have of global change is assessed through interviews. Such changes, as well as new fishing regulations, are found to negatively impact the livelihood of the local populations through the degradation of provisioning and cultural ecosystem services.

In a comparative study in a temperate forest in Switzerland, we perform landscape-level biodiversity studies to understand changes of functional diversity and their impact on ecosystem services, such as climate regulation and food supply. At Lake Zurich, Switzerland we use small-scale micro-cosmos in a laboratory together with large-scale observations in the lake to predict how climate warming affects seasonal dynamics of phytoplankton in aquatic ecosystems.

In our Borneo study sites, we are committed to study the role that high diversity plays in supporting functionality and stability of tropical rainforests. Here we run several projects including biodiversity studies, the ecological genomics of phenology, quantification of ecosystem services and governance of the rainforest. Overall, we believe that many of the limitations we have in our ability to predict, mitigate and adapt to global change can be reduced by the study of feedback mechanisms at different scales. Our cross-site projects assess this issue at a regional scale, by linking datasets along a latitudinal gradient, and at a larger scale, by using globally continuous temporal data to analyze vegetation productivity hotspots. For more information on our research, please visit our website.

In September of this year, we will be hosting a poster session at the IUCN World Conservation Congress in Hawaii (session n°9858). With our poster we aim to: a) highlight the need for more integrative, culturally diverse and trans-disciplinary research projects, b) showcase our project internationally so others can benefit from our experience, c) connect with other scientists engaged in data sharing complementary efforts, d) reach out to a broader group of stakeholders, policy makers and the general public with new questions, challenges and solutions; creating new dimensions to our work. We encourage all of you at IUCN 2016 to visit our poster and get connected!

URPP Global Change and Biodiversity team group retreat (Credit: URPP GCB)

Acknowledgements*: The authors would like to thank the Steering Committee of the URPP GCB for their support in our activities, particularly Owen Petchey, Bernhard Schmid and Michael Schaepman. A special mention to Michael Schaepman and Gabriela Schaepman-Strub for the editorial corrections to this article and everyone at the URPP GCB for their contributions.*

Adaptation to climate change impacts in water regulation and supply for the area of Chingaza-Sumapaz-Guerrero - *Angela Andrade*

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The Ministry of Environment and Sustainable Development of Colombia, through Conservation International-Colombia, is undertaking a climate change adaptation project in the High Mountain Ecosystems that surround the city of Bogota and provide drinking water for the Bogota metropolitan area and its adjoining rural communities. This project is a GEF- SCCF[1] grant implemented by the IDB[2], and is co-financed by IDEAM[3], the Water Facility[4] from Bogotá and two Regional Environmental Authorities: CAR[5] and CORPOGUAVIO[6]. The main objective of this project is to address the consequences of climate change in the water supply and hydrological regulation functions provided by high mountain wetlands (páramos) and ecosystems of the Chingaza-Sumapaz-Guerrero corridor in the central Andean region of Colombia.

The natural water regulation function of these ecosystems is expected to be seriously affected by changes in the intensification of the water cycle, reduced wetness in the upper layer of the soil, higher evaporation rates, higher soil and lower tropospheric temperatures and shifting of altitudinal dew points. These changes are reducing the ecosystem´s capacity to maintain a regulated water cycle and water storage capacity. The project has two main components.

The first component includes the transfer of information and knowledge about climate change impacts on water regulation to local communities and key stakeholders as a basis for more effective hydrological management. The main knowledge products for this component include climate change scenarios downscaled reflecting changes in high mountain ecosystems and páramos, and vulnerability assessment of the high Andean ecosystems, above 2.600m to climate variability and climate change (1:25.000). In order to evaluate hydrological risk, this assessment gives special emphasis on socio-cultural and gender aspects affecting water management; and the "adaptive territorial structure". These knowledge products are currently under development.

Páramo de Sumapaz, one of the project areas located at 3.900msnm (Credit Angela Andrade)

The second component is related to the adoption of measures to address impacts of climate variability and change on the hydrological balance of prioritized areas. These measures aim to increase the buffering capacity of mountain wetlands and socio-ecological systems existing in the territory through the development of restoration activities and establishment of connectivity of natural ecosystems; adoption by farmers of climate resilient land use management practices in local production systems; and redesign and modification of hydraulic works in critical water supply areas to increase water storage

[1] Global Environmental Facility- Special Climate Change Fund.
[2] Inter-American Development Bank, implementing entity of the project.
[3] National Institute of Hydrology, Meteorology and Environmental Studies.
[4] Empresa de Acueducto y Alcantarillado de Bogotá.
[5] Regional Environmental Authority of the Department of Cundinamarca.
[6] Regional Environmental Authority of the Guavio Region.

capacity. In addition, the region´s institutional capacity for land use planning is being strengthened through the adoption of the "adaptive territorial structure", that aims to maintain the ecological integrity of the territory in the long term, and will be considered mainly in municipal and land use plans, development plans and watershed management plans.

For further information, contact Angela Andrade or Rodrigo Suarez, Climate Change Director, Ministry of Environment of Colombia. RSuarez@minambiente.gov.co

Harnessing insect ecosystem services for climate resilient mountain livelihoods- *Paul A. Egan*

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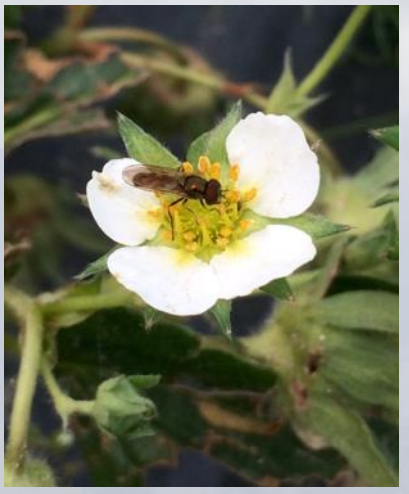

Currently in its inception stage, Paul Egan's upcoming project incorporates climate-smart solutions in the use of mountain ecosystem services to achieve poverty alleviation as well enhance community adaptation to climate change. In March 2016, Paul successfully undertook a preliminary research visit to Nepal to develop partnerships with various community stakeholders. The project directs attention to the often overlooked ecosystem services of pollination and natural pest control, and how their commercial development (as "payment for ecosystem services" schemes) can enhance the resilience of smallholder farming systems.

Cultivation of strawberries in temperate mountain climate, Nepal. Strawberry is an emerging cash crop in Nepal largely reliant on insect ecosystem services. Insufficient pollination and pest damage (depicted) can severely impact yield, and reduce farmer income (Credit Paul Egan)

Nanda Van restoration program - *Paromita Ghosh*

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Restoration of degraded sites and enrichment of fragmented forests is the corner stone of the socio-economic development stream at the G. B. Pant Institute of Himalayan Environment and Development (GBPIHED).

The forest regions in and around the Himalayan city of Almora, Uttarakhand are mostly reserve pine forests that earn significant revenues for the government's forest department. However, local residents routinely face shortages of fodder and fuelwood. Due to the dearth of fruit trees in the region, their largely subsistence agricultural lands also remain highly susceptible to invasions by wild monkeys. Quite often, residents set fire to accumulated pine needles to clear the forest floor so grass and other vegetation can regenerate which can be used for cattle grazing. Often these fires get out of control due to heavy winds, causing loss of biodiversity as well as economic losses to the forest department.

The local civic body approached GBPIHED for assistance. Enrichment plantations of reserve pine forests were initiated in August 2014 during the rainy season. Enrichment plantations improve forest heterogeneity, increase terrestrial carbon sinks by facilitating carbon capture and sequestration and enhances floral and faunal biodiversity.

The enrichment plantation program follows the guidelines of the *Badrivan restoration model* which is an innovative model aimed at the restoration of degraded land, enrichment plantation and biodiversity conservation (Dhyani, 2003). The model demonstrates how science and religion can work together to simultaneously achieve environmental conservation as well as the preservation of spiritual and cultural values.

It is rather expensive to hire labour to plant and subsequent maintain trees in the region's extreme topography. Therefore, following the Badrivan model, GBPIHED achieved community support by closely integrating prevailing religious and spiritual beliefs into its programmatic design. In this region, every mountain peak is understood as the abode of a god or goddess from Hindu mythology, mostly *Shiva* or his consort *Parvati*. At the current site, the goddess Nanda is considered the presiding deity, therefore the program was named *Nanda Van* (Nanda Forest) restoration programme. This motivated pilgrims and locals to dig pits and plant saplings of 15 different multipurpose tree species, including fruit trees, in between pine trees as identified during community consultations. The institute's scientists and staff as well as members of local civic body have also participated in these *religious plantations,* which are carried out every year during the rainy season.

Naming the enrichment plantation as *Nanda Van* sufficiently evokes a sense of responsibility and reverence in the minds of local residents. Plantations are now guarded and maintained by the same local residents who were previously involved in setting the trees on fire. It has been agreed that after 15 years, when the forests have sufficiently regenerated, local residents will be entitled to regulated harvesting for forest products.

Not only is this an excellent example of community engagement to achieve ecosystem management, principles of the Badrivan model can be applied to other contexts where sacred sites and ritual pilgrimage coincide with environmental degradation.

Acknowledgement: *The author is thankful to Dr. P. P. Dhyani, Director of GBPIHED for facilitating the writing of this article.*

Reference: Dhyani, P. P. (2003). Badrivan: An Innovative model in the Indian Central Himalaya for restoration of degraded lands and biodiversity conservation. *XII World Forestry Congress, 2003.* Quebec City, Canada.

Nanda Van enrichment plantation site. Above: Freshly dug pits. Below: plantation in progress. (Credit Dr. S. Airi)

World Conservation Congress 2016

Mountain protected areas: Leadership for adapting to a changing world - *Peter Jacobs*

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Peter Jacobs has been successful in securing a knowledge café session at the World Conservation Congress in September 2016. This consists of a hosted and facilitated roundtable discussion involving up to 12 people.

The aim of the *Mountain Protected Areas: Leadership for Adapting to a Changing World* knowledge café is to bring together the international mountain network and its various organizations and key people to discuss the threats and future challenges to conservation of mountain protected areas around the world – with a particular focus on climate change and the alpine zone.

The knowledge café will invite participants to address and discuss topics around threats, resilience, capacity, connectivity, unprotected Key Biodiversity Areas (KBAs), and reviewing current Mountain Protected Area (MPA) guidelines.

The key outcome will be a greater understanding of the challenges that face conservation of mountains and to identify key leadership action/s the *Mountain Protected Areas Network* can support and contribute to, for the next IUCN Program period and beyond.

Peter will be looking for contributions from the Mountain Network or Mountains Ecosystem Thematic Group and mountains specialists, if you are planning on attending the IUCN WCC and interested in joining the Mountain Knowledge Café please contact Peter, he would welcome your support, participation and input.

Symposiums, Workshops and Conferences

Call for papers - Symposium on Climate Change Adaptation in Asia - *Sejuti Basu*

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Mountains are home to almost 800 million people around the world and provide critical ecosystem services, including freshwater. However, these ecosystems are also extremely sensitive to climate change impacts. Please share your experiences on climate adaptation in the mountains and other fragile ecosystems in Asia at the symposium hosted by Pragya, Hamburg University of Applied Sciences, Manchester Metropolitan University, TERI University and ICCIP in New Delhi, India from 1-3rd February 2017. The Symposium on Climate Change Adaptation in Asia will focus on "strengthening sustainable development and adaptation capabilities" by showcasing experiences from research, field projects and best practice in climate change adaptation in Asian countries. The accepted papers would be published as part of award-winning book series "Climate Change Management" by Springer and in a special issue of the International Journal of Climate Change Strategies and Management.

Call for registration for the World Mountain Forum 2016 - *Faustin Gashakamba*

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The Government of Uganda through its Ministry of Water and Environment (MoWE) jointly with Albertine Rift Conservation Society (ARCOS) and in collaboration with partners in a global program "Sustainable Mountain Development for Global Change (SMD4GC)" financially and technically supported by the Swiss Agency for development and Cooperation (SDC)", are calling for everyone interested in Sustainable Mountain Development (SMD) to start registering for the third

World Mountain Forum 2016. The Forum will be held in Uganda at Mbale from 17th to 20th October 2016 with the overall theme: "*Mountains for our Future*".

The Forum brings together mountain stakeholders from around the globe, and provides a platform for exchange, promotion of collaborative action and fostering political dialogue among different levels of society. The overall goal of the World Mountain Forum is to engage dialogue with articulated, concrete actions and concerted efforts to address the plight of mountain ecosystems towards Sustainable Mountain Development. The Forum will cover four themes namely;

1) Mountains and Climate Change;
2) Mountain Communities and Livelihoods;
3) Mountain Ecosystem Services; and
4) Sustainable Mountain Agriculture.

If you are interested in and want to contribute to Sustainable Mountain Development, register through the event website. The registration fee is $50 and you will confirm your payment of the fee upon registering on the website. There is limited funding/sponsorship for especially active contributors and participants from developing countries. Self-funded participants are strongly encouraged to apply.

Further contacts:

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Send submissions for the next issue of Mountain Ecosystem News to omer.aijazi@gmail.com

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